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Control Of The Shot-Hole Borers In Citrus Trees

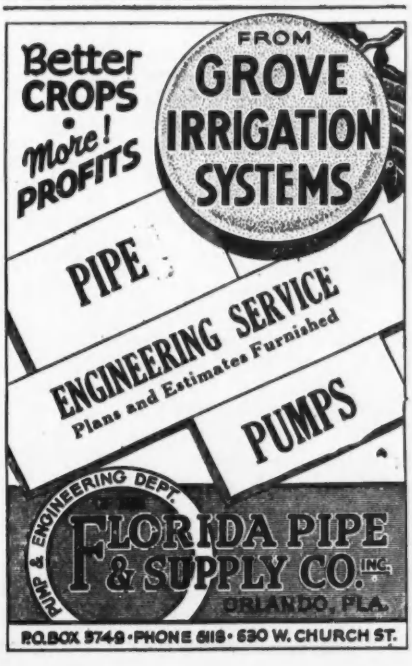
W. L. THOMPSON
Citrus Experiment Station

The shot-hole borer has been reported as attacking citrus trees to a greater extent this fall than during any period in recent years. All of the infestations reported to date have been in groves where some of the trees were planted in lowland and the roots have been either injured or killed by the high water table during the past summer. It is characteristic of these beetles to attack trees that have had the root system injured either by water or some other agency.

The female beetles bore small round holes through the bark and deposit eggs which hatch into small white grubs. Infested trees are usually detected by the white sawdust caused by the beetle grubs boring into the trees. Sometimes when the beetles become abundant they will attack healthy trees, however, as a rule the larvae do not mature but are killed by the flow of sap which either drowns or smothers them. When the roots of a tree are injured the flow of sap is not sufficient to prevent the grubs from feeding and if the trees become heavily infested the injury by the borers plus the effect of the limited root system may cause the trees to die.

These beetles have been very difficult to control in the past but apparently DDT is effective in killing the adults if the trunks of the trees are kept covered with that material. In groves where DDT was used many dead beetles and no new entries were observed after the trunks of the trees had been sprayed. On adjacent trees where the trunks had received either a heavy application of whitewash or no treatment at all, the beetles continued to bore into the trees There was no definite indication that the spray killed the grubs working in the tree, however, one dead grub was found half way out of one of the galleries. A week after the spray the sawdust like substance was observed on some trees and on others it was absent. Since the galleries are filled with fiber it is doubtful if any spray reaches the grubs once they start , boring into the wood. Two months after the treatment no signs of fresh sawdust were observed in treated trees which indicated that the beetles died before they had eaten through the bark and deposited eggs. Two months after the first application of spray an occasional new entry was observed at ground level where sand may have prevented the spray from coming in contact with the bark so a second application of DDT was necessary near the ground on some of the trees.

(Continued on page 21)



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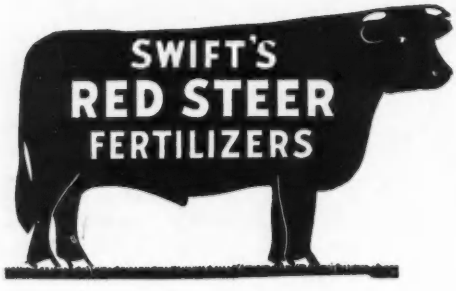

SWIFT & COMPANY, Plant Food Division, Bartow, Florida

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Present Status Of DDT As An Insecticide

JOHN T. CREIGHTON
Head Department of Entomology
College of Agriculture
University of Florida, Gainesville

This paper was presented at meeting of Florida State Horticultural Society:

(Part One)

Introduction

The use of chemicals in the control of injurious insects has made striking technical advances during recent years. The "hit or miss" methods employed in testing insecticides, during the "horse and buggy days" of applied entomology, have been replaced by the strictly scientific planning of experiments and careful mathematical analysis of data. Such worthy trends have resulted in the discarding of some of the old standby remedies and their replacement by the more worthwhile modern developments.

Though advancement has been good in recent years we may still look upon modern entomological research in the chemical insecticide field as one of a semi-pioneer character. There is so much fundamental and diversified research yet to be done that it will tax the ingenuity of all present professional entomologists as well as those who enter this extremely important field for many years to come.

Entomologists have long sought the ideal insecticide. Such a material should have the following characteristics: 1. High toxic in proportion to cost and permissable strength, 2. Ease of miscibility, 3. Good adhesive, spreading, and wetting powers, 4. Easily procurable and transportable, 5. Keep well under varied conditions of weather and climate, 7. Applicable at all times of year and under all conditions of weather, 8. Should not be liable to spontaneous combustion, explosion, or chemical disintergration, 9. Toxic to a wide range of insects and comparatively harmless to man and domestic animals, 10. Should be compatible with other materials used in sprays and dusts, 11. Equally effective as a contact and stomach poison, and 12. Should have residual qualities.

It is doubtful if an insecticide will ever be developed that possesses all of these characteristics. However, DDT approaches nearer to the ideal than any poison that has appeared on the insecticide scene thus far.

Historical

The famous chemical compound which bears the generic name of "dichlorodiphenyltrichloroethane" and is commonly known by the abbreviated name of "DDT" was first prepared by a German chemistry student, O. Z. Zeidler at Strasbourg, as a routine synthesis, in 1874

This great chemical remained insecticidally unknown from 1874 to the year 1939-1940 when Paul Muller of Switzerland, during routine testing, revealed the effectiveness of formulations of this compound in the control of insects. Additional early research was performed by The Swiss Federal Experiment Station.

The initial patent covering the use of this compound was filed in Switzerland in 1940. British patents were granted in 1942 and United States patents in 1943.

The Geigy Company of New York imported some of the Swiss formulations and in 1942 samples of these insecticides (Gesarol Spray Insecticide and Gesarol Dust) were given to the United States Bureau of Entomology and Plant Quarantine for testing at the Orlando Florida laboratory. Knipling (1). Thus began the most extensive insecticidal research program that has ever occured in the world. It is now being tested by nearly every capable economic entomologist in the United States, and many American entomologists in the Armed Services.

Characteristics

The original DDT prepared by Zeidler was made by allowing Anhydrous Chloral and Chloroben-

zene to react in the presence of concentrated Sulfuric Acid. The generic name for the resulting compound is "dichlorodiphenyltrichloroethane." It is a synthetic organic chemical more properly known as-2, 2-bis-(p-chlorophenyl) 1, 1, 1-trichloroethan, I. (C14 H9 C15).

There are two grades of commercial DDT available. These are "Technical DDT" with a setting point not lower than 88 degrees centigrade, and "Purified DDT" with a melting point of 108-109 degrees centigrade. "Technical DDT" is used in most agricultural work, while "Purified DDT" is used in Aerosols.

In the commercial production of DDT the chlorobenzene and chlorol hydrate, sulfuric acid process is usually employed. The resulting "Technical DDT" consists of a mixture of DDT isomers, and certain materials which are termed impurities. The major DDT isomers are the para-para-prime isomer which comprises 65-73 per cent of the product, and the ortho-para-prime isomer which exists in amounts of 18-21 per cent. The latter has insect toxic value, but it is not as effective as the para-para-prime isomer. The remainder of the product consists of an unimportant isomer, oily by-product, and impurities.

"Technical DDT" varies in color from off white to dark grey. It has a fruit-like odor. Upon purification the resulting "Purified DDT" is a white, waxy, crystalline powder. It is almost odorless. The melting point is 108-109 degrees centrigrade. Thus far a satisfactorily practical method for separating the DDT isomers has not been developed.

DDT is not as stable as was first indicated. It breaks down at high temperatures. It loses its residual effects comparatively quickly under conditions of high summer temperatures. The residual quality of DDT is greater in buildings than on plants or animals. DDT formulations should be stored in cool places. Gunther (2).

DDT is insoluble in water but soluble in most organic solvents. It is rather soluble in petroleum and vegetable oils. The solubility range of DDT in the most useful solvents follows:

Solvent	Solubility (Grams DDT per 100 ml. solvent).
Cyclohexanone	100-120
Dioxane	91-100
Methyl chloride	84-91
Benzene	77-83
o-Dichlorobenzene	63-71
Tetrohydronaphthalene	63-71
Xylene	56-62
Acetone	50-55
Carbon tetrachloride	46-48
Cotton seed oil	9
Kerosene	8
Mutyl alcohol	6
Deodorized keresone	5

Formulations

Pure DDT is not highly effective as an insecticide. However, the proper formulations of this chemical with other materials intensifies its insecticidal efficiency for the control of certain species. Thus far a definite specificity of action has been revealed. In this connection it is interesting to note that some of the insects previously considered easily controlled by standard insecticides are not susceptible to the formulations of DDT thus far employed (cotton leafworm), while some species that have resisted man's chemical control efforts for many years are quite susceptible (pink bollworm).

It is quite likely that as research continues newly developed and more effective formulations will greatly broaden the usefullness of DDT as an insecticide. It is also true that results are being reported so rapidly that defective or inconclusive experimentation may be the cause of some negative results.

Formulations of DDT may be water suspensions, solutions, emulisions, dusts, or aerosols.

Water Suspensions.— Water suspensions may be of three types: namely a mixture of finely ground DDT with water: solution of DDT in a water-miscible organic solvent diluted with water; and DDT impregnated or coated diluents mixed with water.

In preparing a finely ground DDT for mixing with water it is necessary to use a diluent such as calcite, talc, or pyrophyllite, as DDT becomes soft below 88 degrees C. The DDT is usually mixed with the diluent at 1-10 percent levels. They may be ground in a hammer mill. Such mixtures may be satisfactorily wetted with water and used as sprays or wetting agents may be added to facilitate distribution. Such sprays usually require agitation.

Solutions of DDT in water-miscible solvents such as acetone, or ethyl, methyl, or isopropyl alcohols will result in a very flocculent precipitate when such solutions are mixed with water. The precipitate is finely divided and may be kept easily suspended.

Solutions.— Solutions of DDT in organic solvents such as petroleum oil, xylene, or acetone have been used for residual spraying and cloth impregnation.

Solid solutions have been prepared by Bureau of Entomology and Plant Quarantine workers. These have been successfully used as a control for anopheline mosquito larvae. Jones et al. (5).

Emulsions.— Emulsions may be made of DDT which is previously dissolved in numerous solvents which are slightly soluble or practically insoluble in water. Consideration must be given the kinds and quantities of the emulsifiers used as it will influence the contact toxicity of the lethal agent.

The two main types of emulsions are those with DDT dissolved in a volatile solvent (xylene), and those in which DDT is in a nonvolatile solvent (petroleum oil). The first type distributes DDT crystals on the sprayed surface upon evaporation of the xylene, while in the latter type the surface is coated with a DDT solution on evaporation of the water carrier.

Dusts.—It is very difficult to grind pure DDT due to the low melting point. However, it may be successfully ground when mixed with inert diluents such as pyrophyllite, talc, or walnut-shell flour. Such grinding may be done commercially or in a laboratory hammer mill. When the concentration of DDT is high, care must be taken to prevent overheating of the mill.

Commercial mixtures prepared for grinding do not usually contain over 30 percent of DDT. Though dusts of 10 percent DDT are used, the 1 to 3 percent dusts seem quite effective for many agricultural pests. Particle size may range down to 3-4 microns which is quite suitable. Chisholm (6) and Jones et al. (5).

Aerosols.— In 1942 Goodhue and Sullivan described the preparation of insecticidal aerosols which use liquified gases as dispersing agents for insecticides. The propellent employed was liquid dichloro-difluoromethane (Freon 12). Goodhue and Sullivan (7).

Smith and Goodhue have now tested the application of DDT by the aerosol bomb and have found it successful. The method of preparation is to dissolve commercial DDT in an equal weight of syclohexanone. This solution is filtered and introduced into the container. which is then filled with Freon 12. Under

atmospheric conditions Freon 12 will rapidly volatilize distributing the DDT. Smith and Goodhue (8).

Compatibility

The determination of the degree of compatibility between DDT and other spray materials is still elementary, and in a state of flux.

It is quite evident that it should not be combined with hydrated lime in dust mixtures as the lime reduces the toxicity of DDT. In liquid sprays the addition of lime does not have a great effect upon toxicity, but its use is not usually advised. Some colloidol clays are reported to have similar effects.

DDT can be mixed with dusting sulfur, wettable sulfur, pyrophyllite, talc, or walnut-shell flour.

Some workers record a reduced DDT period of effectiveness when used with boredeaux mixture, linesulfur, and sulfur. This may be due to a physical masking of the DDT or decomposition to insecticidally inert compounds. Chishom (6).

Chemical Determination

Specific methods of chemical determination of DDT have been described. Hall has described a modification of the Winter method for the determination of halogen in organic compounds. The sample is volatilized and then burned in a jet of illuminating gas. The combustion products containing chlorine are absorbed in an alkaline solution of sodium arsenite. The solution is titrated for the chloride ion, using standard silver nitrate and ammonium thiocyanate solutions. Hall (9).

Hoskins described the method he employed as follows: "'A quantitative analysis for DDT may be based upon a certain fact, namely that when the compound is warmed with alcoholic alkali, one molecule of hydrogen chloride is split out. This liberated chloride may then be determined by any quantitative method such as titration with standard silver nitrate solution, chromate being used as indicator. To exclude inorganic chloride, the sample suspected of containing DDT is extracted with benzene, in which DDT is readily soluble but inorganic chloride is not." Hoskins (10).

pscvh bhl-,e

Physiological Effect Upon Insects

DDT acts both as a contact and stomach poison. This double action makes it a suitable poison for insects with piercing and sucking, as well as those with chewing mouth parts. In servxing as a contact poison it may enter the body thru any non-sclerotized tissue or thru perceptor organs. In the case of the common housefly (Musca domestica I.) it reaches great heights of effectiveness as a contract poison and as a residual spray. It is evident that this exceptional lethal value is due primarily to the perceptor organs on the pulvilli (pads) of the tarsomeres (segments) of the fly's legs. It is only necessary for the fly to rest momentarily upon a surface coating of DDT to receive a lethal dose.

The physiological action of this poison, after entrance into the insect body, seems to be primarily as a nerve poison. It causes definite nervous spasms that are reflected in the peculiar jerking of the muscles of the body which control segment activiity as well as the appendages. The typical jerking response to the poison is frequently termed the "DDT Jitters".

The lethal action of DDT is relatively slow as compared with some of our other contact sprays. This reduces its knock-down value but not the percentage of kill. Some insects live 12 to 72 hours after contact with lethal quantities of the poison.

Physiological Effect Upon Vertebrate Animals

DDT in sufficient quantities is poisonous to vertebrate animals, including man. This will not preclude its effective use in the control of insects. It will merely necessitate the employment of protective measures to prevent the intake of lethal quantities.

It is too early in the study of DDT to present an overall picture of its lethal effect upon man and other vertebrates.

The United States Public Health Service and other agencies are making detailed studies relative to the effects of the chemical. Nelson et Al., have made reports relative to their experiments on rabbits, rats, guinea pigs, mice, chickens, dogs, cows, sheep, and horses. Nelson at Al. (11).

It has been indicated that DDT dusts containing not more than 10 per cent DDT, and Aerosols with not more than 5 percent DDT should not present a serious health problem. The powder does not seem irritating when applied to the skin in the dry form but can be when dissolved in organic solvents and oils.

If taken internally it may cause loss of appetite and nervous spasms. In sufficient oral doses convulsions and death of test animals occured. Though DDT is not a cumulative poison the effects of the poison upon tissues may possibly be accumulative.

The Federal Insecticide Act does not require labels for DDT formulations. However the hazards involved in the use of DDT make it mandatory that products containing it be so labeled as not to indicate that it is entirely safe. A caution statement should appear on each label to avoid personal injury.

DDT should be handled as any other dangerous compound. All mixing operations should be isolated. Greater concentrations of dusts, liquids, or aerosols than necessary should never be used.

The operator who applies DDT should use every reasonable precaution including masks, respirators, and gloves. The poison should never be stored near or with foods.

Physiological Effect Upon Plants

Numerous tests relative to the physiological effects of DDT upon plants are being made. Some reports of plant injury have been recorded. Roark et Al. (12). This research work is in a very elementary stage at present and it will be necessary to test the many formulations which are being developed upon a wide range of plants under numerous climatic and weather conditions before this complete problem can be solved.

Insecticidal Efficiency

In the history of insect control there has never been a compound developed which has demonstrated such excellent insect control qualities as DDT Its immediate value as a stomach or contact poison is tremendous and its residual qualities may extend the uses of this compound. Such a compound will naturally have a terrific inpact upon all types of pest control, but its use will be limited by its toxicological effects upon man, domestic animals, plants, wild life, and beneficial insects.

POSSIBLE USES OF DDT

Pests of Gardens and Truck Crops

DDT is destined to play an important part in Florida crop production because of its use in the control of certain pests of garden and truck crops. Though most investigations are still preliminary in character and in some specific instances there is definite disagreement concerning the control of certain species, enough laboratory and field data have been assimilated and reported to indicate that this compound in various formulations will definitely enter the control complex for pests of many plants.

Indications are that such note-

(Continued on page 22)

The U. S. Horticultural Council And Futrue Citrus Exports

J. WAYNE REITZ
United Growers & Shippers Ass'n., Orlando, Fla., at Meeting of Florida State Horticultural Society, Orlando

Horticultural interests the country over are aware of or should be aware of their stake in the export market. Prior to the outbreak of World War II the volume of export of fruits was being maintained or increased while the export of other agricultural products was on the decline. In fact, of food products, fruits led the list in exports and for the five-year period ending with 1938 constituted 13 percent of the total agricultural exports. Thus, it is important that foreign outlets be recognized as an important means of relieving the pressure of future supplies on our domestic market.

At the same time that horticultural interests are aware of the importance of exports, they are also cognizant of the fact that for years to come there may be serious impediments to international trade. Through government controls not only of our own but that of other countries and through lack of proper organization within the horticultural industry, the possibilities of maximizing our exports may be missed.

To assist in meeting some of the problems with which the horticultural industry will be faced in its export operations, there is now being formed an organization known as the United States Horticultural Council. The name of this council may be somewhat misleading to a group familiar with the functions of the Florida State Horticultural Society. It is a perfectly good name, however, as far as the groups represented are concerned. The purpose of the Council, as outlined at an organization meeting, are as follows:

1. To collect, assemble, compile, analyze, and distribute statistical and other information relating to export trade in fresh and processed fruits, vegetables and nuts commercially grown in the United States, and the products thereof.

2. To cooperate in the formulation, encouragement and promotion of plans for export trade in horticultural commodities.

3. To provide a means for close collaboration between the various government agencies and the horticultural industry of the United States in all matters relating to export trade in horticultural commodities.

4. To prepare factual data, to inform, to consult, to advise with, and to make recommendations to, the Secretary of Agriculture, the Secretary of Commerce, the Federal Trade Commission and other government agencies in the formulation and execution of any program which will develop export trade in horticultural commodities.

The Council is composed of representatives from eleven commodity groups. These groups consist of apples, pears, citrus fruit, table grapes, stone fruits, dried fruits, tree nuts, canned fruits, canned vegetables, vegetables fresh, and potatoes and onions. Each of these groups has one vote on the Council but may be represented by as many as five individuals. Potentially then, there could be fifty-five representatives on the Council even though only eleven votes would be cast when decisions are being made.

The Florida citrus industry has taken a very active part in the formation of this Council to date and has been honored with the selection of Mr. Marvin H. Walker as national chairman. Representing the Florida citrus industry is a Florida State Committee consisting of Messrs. Lorin Bice, Chairman; Albert Connelly; R. A. Fender; C. E. Lindsey; C. C. Rathbun; and Marvin Walker.

As indicated in the purpose of the organization, the Council will be primarily concerned with general policy affecting foreign trade in horticultural products. As such the organization will confer with and advise the appropriate government agencies on such problems as exchange control, quota restrictions, tariffs, transportation, and the like. Unless our horticultural interests are kept well informed of the action taken by our own and other governments as they affect foreign trade, and unless we can advise in the action taken, it can be very easy for certain groups to obtain concessions at the expense of citrus and other fresh fruit interests.

While the United States Horticultural Council has important functions to fulfill of vital interest to the Florida citrus industry, it does not follow that we would rely on it to regain and expand our foreign outlets. That we must do ourselves. It is not the purpose of the Council to dictate what we shall do, but only to facilitate through our government and foreign governments those programs which we contemplate carrying out.

In evaluating the future of citrus exports from Florida, statistics of the past, while helpful, are at best only indicative of what may be done in the future. The situation with respect to purchasing power of foreign countries, government control of foreign trade, and competing areas of supply has so changed that statistics of the past need to be completely revalued. We do know that up until the outbreak of World War II the United States exported, on the average, approximately 7

(Continued on next page)

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Geo. E. Chambliss Succeeds H. L. Askew

George E. Chambliss, of Winter Haven, Fla., has been named to serve as alternate member from District 7 on the Growers' Administrative Committee of the Florida citrus marketing agreement and order program for the remainder of the year ending July 31, next. Announcement of Mr. Chambliss' designation was made by the U. S. Department of Agriculture in Washington.

Mr. Chambliss succeeds the late Harry L. Askew, of Lakeland, who died in September.

Crop Insurance For Citrus Fruit Delayed

Hopes of securing a trial test of crop insurance for citrus fruits this year have been blighted. The plan at first called for trial tests in Orange, Lake and Polk counties, but last month Polk county was eliminated by the Federal Crop Insurance Corporation.

Now both Orange and Lake counties have been included in the postponement of the program for at least another year.

THE UNITED STATES HORTICULTURAL COUNCIL AND FUTURE CITRUS EXPORTS

(Continued from proceding page)

percent of the orange crop and 5 to 6 percent of the grapefruit crop, as shown by Table 1. Beginning with the 1939 season exports fell drastically insofar as Europe was concerned but since Canada was and has been our chief customer, orange exports in terms of boxes equalled approximately the pre-war average but dropped to about 5 percent of the total production because of the increase in production.

In the case of grapefruit, exports were fairly well maintained even during the war since Canada customarily absorbed the great bulk of such movement. Percentagewise, exports of grapefruit were on the decline prior to the war, as shown in Table 1. However, this decline is largely offset by a rapidly expanding volume of canned grapefruit segments and grapefruit juice. From the 1935-36 through 1939-40 season the equivalent in boxes of processed grapefruit exceeded that of fresh shipments going into export.

Unfortunately statistics on exports are not broken down by areas of production. Hence, of the total we do not know the amount originating in Florida. For orange exports, California no doubt supplied a large portion, especially in overseas trade. In the case of grapefruit segments and juice we do know that Florida shipped the bulk of these products.

(Concluded next issue)

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COLONEL BAYARD F. FLOYD

In the death of Colonel Bayard F .Floyd, which occurred on November 8, the Florida citrus industry loses one of its best known, most influential and best loved members.

A native of Indiana, Colonel Floyd has been a resident of Florida since 1907 and during all those years had been intimately identified with the citrus interests of the state. From 1907 to 1920 he served as plant physiologist at the Florida State Experiment Station. In 1921 he became vice-president of the Wilson & Toomer Fertilizer Co., and the Florida Agricultural Supply Co. Since 1917 he had been secretary of the Florida State Horticultural Society, giving unstintedly of his time and energy to the affairs of the Society. The interesting, instructive and successful programs of the Society throughout the years of his service as secretary were due in large measure to his untiring efforts.

As a member of the Research Advisory Committee of the Florida Citrus Commission, Colonel Floyd took an important part in expanding the research work of that body. He took an active interest in every phase of the citrus industry and his qualities of leadership were recognized throughout the state.

In the death of Colonel Floyd the industry loses a true friend, an ardent supporter, a capable leader, a man of endearing personality and sterling worth.

PRICE CEILING SUSPENDED

Suspension by the Office of Price Administration of ceiling prices on citrus fruits, temporarily at least, resulted in a spectacular rise in the price of such fruits during the first few days following the suspension.

Growers and shippers had asked for the complete removal of price ceilings and were disappointed that only a temporary suspension was granted with the threat that ceilings would be restored should prices appear to be getting out of bounds.

In an effort to head off any such action, the Federal Citrus Marketing Agreement Committee has added size 288 oranges to the list of fruit which may be permitted to move to market, thus adding to the supply and tending to hold down the price. The committee also has asked the government to permit a shipping holiday from December 24 to December 31. Such a shipping holiday last season operated to keep prices from undergoing a January slump to which growers and shippers had become accustomed. Should this shipping holiday be granted, it is expected to result in a spurt in movement prior to the holiday which may have an appreciable effect upon prices, and serve to ward off the threat of restoration of ceilings, for the time being at least.

High retail prices in the North, entirely out of line with prices received by producers and wholesalers, brought a quick threat of removing the suspension and restoring price ceilings. A hearing has been called for Washington on Dec. 13, at which Florida interests will attempt to prevent such action.

SPESSARD L. HOLLAND

The Citrus Industry has no hesitancy in giving its endorsement to Spessard L. Holland in his candidacy for United States Senator.

As a State Senator and as Governor of the State of Florida, Mr. Holland has proven his ability and sterling worth. He is eminently qualified for the position of United States Senator. His long and intimate association with the citrus interests of Florida constitute an added reason why his candidacy is enthusiastically regarded by the citrus growers of the state.

TRISTEZA STUDY COMMITTEE NAMED

Taking prompt action to make a thorough study of tristeza, the citrus disease which is causing such havoc among South American citrus groves on sour orange root stock, President Frank M. O'Byrne of the Florida State Horticultural Society has announced the appointment of a committee to make the investigation.

Dr. A. F. Camp, vice-director in charge of the Citrus Experiment Station at Lake Alfred, who has made two trips to South America to study the disease, recommended such a committee at the recent meeting of the Horticultural Society. The recommendation was approved by the Society and the president was authorized to name the committee.

With Mr. O'Byrne as ex-officor member, the committee as announced includes the following prominent citrus factors: Thomas W. Bryant, Lakeland, member of the State Board of Control; A. C. Brown, Gainesville, Commissioner State Plant Board; Charles A. Stewart, Auburndale, Chairman of the Research Committee of the Florida Citrus Commission; James C. Morton, Auburndale and Vaverly, Chairman Citrus Division, Florida Farm Bureau Federation; Charles H. Walker, Bartow, President Florida Citrus Exchange; H. B. Snively, President of the Lake Hamilton Cooperative, representing United Growers and Shippers Association.

This committee is thoroughly representative of every element of the Florida citrus industry. It is doubtful if a more representative body of citrus men could have been chosen for the important study to be made. The danger of the introduction of this disease into the United States, the rapidity with which it works, calls for prompt study and vigorous action to prevent its invasion. That such study and appropriate action will be taken, the personnel of this committee assures.

Some Aspects Of The History Of Citrus In Florida

T. RALPH ROBINSON, Terra Ceia, Florida
In Journal of Florida Academy of Science

Interest in the early history of citrus fruits has been awakened in recent years by new facts brought to light bearing on their original introduction into the New World. Perhaps chief among these discoveries is that Columbus himself, on his second voyage, was the bearer of seeds that gave rise to the first citrus orchard in America. Credit for this important find is owing to Virginia Kift Barnes, who published an account of her discovery in a Florida journal, "The Citrus Industry," October, 1934. Up to that time no record existed in American literature of the exact date or manner of introduction of citrus into this part of the world.

In the course of a survey on raw products carried out by the New York City Department of Markets, Miss Barnes consulted Bartolome de las Casas' "Historia de las Indias." This history, written over a period of years (1527-1559), remained unpublished until 1875, when it was finally printed in Spanish. Only parts of this work have yet been translated into English. The portion with which we are concerned is worth considering in some detail. Referring to Columbus' second voyage, Las Casas tells of his departure from the Bay of Cadiz on September 25, 1493, and his stop at the island of Gomera, one of the Canary group (Oct. 11-13), awaiting favorable winds. There he bought seeds and livestock, including eight pigs. Las Casas writes: "From these eight pigs there have multiplied all the pigs which unto this day inhabit the infinite Islands of all these Indies. They bought hens and also grains and seeds of oranges, lemons, citrons, melons, and all kinds of garden vegetables, and this was the origin of everything that there is today of the things of Castille." Thus the exact date of introduction and the exact spot in the Old World —Gomera in the Hesperides or Canary Islands—from which our first citrus came were both recorded by the Spanish friar.

Las Casas goes on to relate that on November 22, 1493, Columbus sighted the island of Hispaniola (that is, Haiti, also called San Domingo), and "here he unloaded his ships of provisions, livestock and materials, built a fort, storehouse and church, set out orchards, planted gardens, and with great diligence erected a new city." This city was named "Isabella," and was located on the north side of the island, not far from the present town of Monte Cristo in San Domingo.

That the citrus seeds sown by Columbus sprouted and prospered we have no reason to doubt. We have, in fact, Herrera's statement regarding Hispaniola and how well it had proved suited to the Negroes imported from Africa: "Like oranges, they found their proper soil in Hispaniola and it seemed even more natural to them than their native land." Also we are told by the naturalist Oviedo, who was in Hispaniola from 1514 to 1525, that "orange trees from Castile were brought to this Island of Hispaniola and they have multiplied so abundantly that they are now past counting; the fruit is very good, both sweet and sour." Thus the spread of citrus must have been very rapid in the two or three decades following the introduction by Columbus. Doubtless Hispaniola thus served as a distributing center for the neighboring islands of the West Indies, for the mainland of the Americas, and possibly for Florida, though there were of course later introductions direct from Spain.

Just when and by whom citrus was first introduced into Florida remains to be discovered. Perhaps a plain statement may repose in some neglected manuscript or publication, as did the long buried record of Columbus' part in bringing citrus seeds to the New World. One of my objects in reviewing this subject is to stimulate historians and others to be on the watch for horticultural information of this kind when engaged on studies of a different order.

It is true that in 1577 Bartolome Martinez, in a letter to the Spanish king, states that he planted with his own hand orange and fig trees at Santa Elena, located on the North Carolina coast. Also, in April, 1579, Pedro Menendez Marques, reporting progress at St. Augustine, states, "there are beginning to be many of the fruits of Spain, such as figs, pomegranates, oranges, grapes in great quantity." This would indicate that citrus had been introduced earlier, possibly by as much as several decades. However, Hume (1) is of the opinion that the introduction of citrus fruits into Florida did not antedate 1565, the year in which St. Augustine was founded. Certain it is that St. Augustine and its environs gradually became one vast orange grove, with schooners carrying loads of the golden fruit to the northern coastal cities over 200 years ago.

It is doubtless true, as Hume states, that the introduction into the St. Augustine area was by seed rather than by grafted or layered plants. In the case of citrus that fact would not be as great a handicap as it might be with nearly all of the other important tree fruits of the world, seedlings of which commonly give rise to plants of inferior and widely divergent fruiting types. In fact, the citrus group and one race of mango are the only important tree fruits known that in the vast majority of instances "come true from seed." This is because their seeds develop extra embroyos derived from the mother tissue of the seed, the nucellus, these extra embryos being therefore genetically the same as buds taken from the mother plant. Even more remarkable is the fact that sprouts from these extra embryos frequently, and in some varieties entirely suppress or supplant those springing from the true or seminal embryo, so that the resulting population resembles the seed parents in all

1 Hume, H. H., The Cultivation of Citrus Fruits. (New York: Macmillan). 1926.

essential characters. This important fact was not recognized until 1878, when Strasburger announced the polyembryonic nature of citrus seed. It doubtless accounts for the fact that there is a remarkable uniformity, generally speaking, in the fruits produced by the old seedling groves that still furnish an important part of the Florida orange crop. These seedlings doubtless trace their ancestry back to a very few parent orange trees that survived the disastrous freeze of 1835, which all but wiped out the sweet orange groves of Florida.

The Dummitt orange grove on Merritt's Island, opposite Titusville, was one of the few surviving groves after that truly great freeze. This grove was unique in that it was not a seedling grove but was composed of trees top-worked or grafted on sour orange rootstock at a height of three feet from the ground. The grafting took place about 1830. That they were grafted trees was discovered when I visited the grove in 1926. The graft union is plainly shown in photographs taken at that time, and reproduced in an article on the history of the grove published in the Proceedings of the Florida State Horticultural Society for 1926. These photographs have also been republished in the recent monumental work on the citrus industry edited by Webber and Batchelor (2). Webber points out that this was probably the first instance of the working over of a wild sour orange grove; the using of such volunteer trees as grafting stocks did not become a general practice until about 1865 or 1870. Despite the fact that this old grove has reverted to a jungle condition several times in the past century, there were still some trees alive according to last report. These veteran survivors of a past era should be promptly acquired and cared for by some official State organization, possibly the Florida Forest and Park Service. It is safe to say that if California could boast of such historic trees they would constitute a shrine to be visited annually by throngs of citrus growers and other visitors.

Notwithstanding the mass uniformity of citrus seedlings, enough variation has arisen, due to mutation or possibly to hybridization, to give rise to most of the valuable orange varieties grown in Florida today. In fact, the Valencia orange is the only budded variety of sweet orange widely grown in this state that is a direct importation from the Old World. Such varieties as the Parson Brown, Pineapple, Hamlin, Homosassa, Enterprise, and Connor, which constitute the great bulk of Florida shipments (exclusive of Valencia and seedling oranges), owe their origin to selected seedlings propagated by budding. The practice of budding was in many instances resorted to in order to utilize as rootstocks the so-called "wild" sour oranges that had sprung up as volunteers, forming thickets along such streams as the St. Johns and Oklawaha rivers. Indian camping and hunting parties are generally credited with the spread of these "natural groves," the fruit and seeds dropped by them around their camp sites giving rise to large descendants in the course of time. One such grove in the Okaloacoochee Slough of the Everglades is estimated to have produced the equivalent of 10,000 boxes of sour oranges annually—until overdrainage and subsequent fires practically destroyed it. It is no wonder that some early visitors to Florida thought that oranges were native to the state, when they saw "wild" trees competing with bays and cypresses for the possession of low rich ground.

Going back to the seeds brought to the New World by Columbus, it will be recalled that no mention is made of grapefruit, Florida's unique contribution to the citrus markets of the world. Not only was grapefruit as we know it unknown to the Old World in Columbus' time—it was and is practically to this day unknown in the Orient, whence all our other citrus fruits originally came. The nearest counterpart to grapefruit in the Orient is the pummelo or shaddock, a native of the islands of the Malayan Archipelago and Polynesia. The name "shaddock" was used in the West Indies for the large, thick-skinned pummelos, because a certain Captain Shaddock was credited with having brought the seed from the East. The fruit was first planted in Barbados late in the 17th century. The shaddock was grown chiefly as a curiosity, although some of the oriental varieties are highly esteemed in their native lands. It now appears likely that it was from the shaddock that the New World acquired the wonderful fruit that we call grapefruit, by mutation or perhaps through chance hybridization.

Grapefruit, is first mentioned, under the name "forbidden fruit," as occurring in Barbados by Griffith Hughes in 1750 and is recorded from Jamaica as "forbidden fruit or smaller shaddock" by Patrick Browne in 1789. In 1814 John Lunan used the name "grapefruit" in his Hortus Jamaicensis. Despite efforts to change the name to "pomelo" the name grapefruit has come into wide use and seems certain to persist. Although for a long time grouped with the pummelos, grapefruit is now recognized as a distinct botanical species, Citrus paradisi Macf. One fundamental difference between grapefruit and the shaddocks is the fact that the latter are unique among citrus fruits in having seeds with but a single embryo, while grapefruit seeds are polyembryonic. This would seem to indicate that grapefruit arose through hybridization between a shaddock and an orange, the polyembryonic character of the orange being dominant. We of the U. S. Department of Agriculture have attempted by crossing to recreate grapefruit, but thus far without success. This is not surprising, since the chances of striking exactly the same combination of characters in a limited number of hybrid seedlings is after all rather remote.

The merits of the new fruit were apparently appreciated by a select few, but it failed to meet popular approval for a surprisingly long time. Introduced into Florida about 1809 by Don Philippe, a Spanish nobleman located near Safety Harbor on Old Tampa Bay, it spread slowly but was grown chiefly as a curiosity or for home use. Not until winter visitors from the North developed a liking for grapefruit was any trade in it established. This happened sometime between 1880

2 Webber, H. J., and L. D., Batchelor, The Citrus Industry. Vol. 1. (Berkeley and Los Angeles; University of California Press.) 1943.

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and 1885, the first shipments north being made in barrels that netted about fifty cents per barrel. Only with the coming of the present century did grapefruit really begin to command a place in the fruit markets of the nation. Once started, the demand increased at a pace hardly paralleled by that shown by any other newly introduced fruit.

An important contribution to the world-wide popularity of grapefruit was the discovery in Florida of a seedless variety generally known as the Marsh Seedless, named for the man who initiated its propagation and distributed it from his Lakeland nursery. Conflicting reports as to the origin of this variety led me to make a thorough investigation of the matter in the spring of 1933. Fortunately this was done while there were still living a number of persons entirely familiar with the original tree and its history. My findings were reported in the Journal of Heredity in November, 1933. The parent tree, a seedling, grew in the grove of William Hancock at Socrum, about 12 miles north of Lakeland. It was a bearing tree when Hancock bought the place in 1862, and was in a decadent condition when the freeze of 1894-95 killed it. Propogation had, however, been started by several persons about 1885, although the value of the variety was not fully appreciated for another 30 years. The Marsh Seedless has been the predominant variety in practically all recent plantings, and is almost the only one grown in the Southwest and in foreign countries that have taken up the growing of grapefruit recently.

A further impetus to grapefruit consumption was furnished when it was discovered, at the time of World War I, that grapefruit would lend itself to canning, making it available for use the year around. How important that factor has become may be realized when it is stated that in recent seasons processed grapefruit has accounted for 50% or more of the total production in Florida. Of course, the demand growing out of the requirements of the Armed Forces and Lend-Lease has had an important bearing on this phase of grapefruit utilization, but even before the war as much as one-third of the crop went into cans.

Another contribution that Florida is at the present time making to the citrus situation is the outgrowth of a citrus breeding program initiated by the U. S. Department of Agriculture in 1894, over a half century ago. At that time Swingle and Webber, in the attempt to create hardier sweet oranges, made numerous crosses between the hardy trifoliate orange and the common sweet orange. Many hybrids, called "citranges", were produced, but none that would serve as true orange substitutes. The program of research was gradually expanded until hybrids had been secured between practically all the main species and varieties of true citrus, and involving some of the more closely allied citrus relatives—an accomplishment unparalleled in the field of subtropical horticulture. The particular hybrid that is now making its debut is that between the grapefruit and the tangerine, known as the tangelo. Thousands of seedlings were grown and tested to secure a half dozen tangelo varieties suited to commercial handling, and maturing at different periods so that tangelos might be available practically throughout Florida's shipping season. It has been my privilege to be intimately associated with this breeding program for the past 25 years, and it is a great satisfaction to see the growing popularity of this new fruit. The tangelos as a class more nearly resemble an orange of superlative quality than they do either of the parent fruits. Their high color of flesh and of peel makes them attractive to the eye, and they bid fair to take an important place in the citrus market, particularly in the fancy fruit and private order trades. The Temple orange, evidently a natural hybrid, should doubtless be classed with the tangelos, which it resembles in many respects. Thus far the tangelos have not appeared very well suited to other citrus growing regions of the United States, so that Florida may prove to have a practical monopoly of this fruit, as it has of the tangerine.

No discussion of citrus developments in Florida would be complete without some mention of the social effects of what may be termed the industrialization of citrus handling. Time was, within the memory of many of us, when a good part of the fruit leaving Florida was packed by the grove owners themselves, in crude packing sheds and with still more crude equipment. The labor for picking and packing was recruited from the immediate neighborhood, and the payroll thus locally distributed was a potent factor in

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With the passing of the local car-a day packing house, and the centralization of fruit handling through very large and well-equipped packing houses serving a wide territory, the picture has greatly changed. The labor of picking and packing has gradually passed into the hands of migrant workers, and the effect may be seen in the decline of some of our rural communities. Greater efficiency both in packing and in marketing is certainly attainable through the present centralization, but it is desirable that the social problems arising therefrom should be recognized and that counter measures be taken wherever possible. It is important that a large proportion of our rural youth should find their surroundings sufficiently attractive and their employment sufficiently remunerative to make them desire to follow the horticultural pursuits of their fathers, instead of drifting to the cities, or perhaps becoming migrant laborers themselves.

Reference has already been made to the recent book edited by Webber and Batchelor, entitled "The Citrus Industry," and issued by the University of California Press. Anyone interested in the development of this industry, not only in Florida but elsewhere in the citrus growing regions of the world, will find this authoritative work invaluable. Another fascinating work, from both a historical and a literary point of view, is "Hesperides, a History of the Culture and Use of Citrus Fruits," by S. Tolkowsky, published in London in 1928. The author has made an exhaustive search of the ancient literature—Latin, Greek, Sanskrit, Hebrew, Arabic, Chinese, Persian, East Indian and Malayan—as well as of works in the more recent European literature, in developing his theme. His greatest contribution to citrus history is his setting back by about eight centuries the probable date of introduction of oranges and lemons into the regions bordering the Mediterranean — especially Italy. Most writers, following the conclusions of Gallesio, have maintained that these fruits did not make their appearance in Italy and neighboring countries until the 10th century A. D., although conceding that the citron was known and grown throughout the Mediterranean Basin for over a thousand years previous to that time—in fact, from the time both by literature references and by the reproduction of murals and friezes dating back to the days of Pompeii, that lemons and oranges of a sort were known at that period of Roman history. His erudite researches thus do more than trace the history of citrus; they give an insight into the art, customs, commerce, and very lives of these ancient peoples.

3 It is an interesting fact that Theophrastus, in describing the flowers of the citron, was the first writer (or botanist) to suggest in effect that flowers had both male and female parts. At least he stated that "of the flowers those that have, as it were, a distaff projecting in the middle are fertile, while those that have it not are infertile." His observation holds true to this day, many of the flowers of the citron being non-pistillate, and thus purely male in character.

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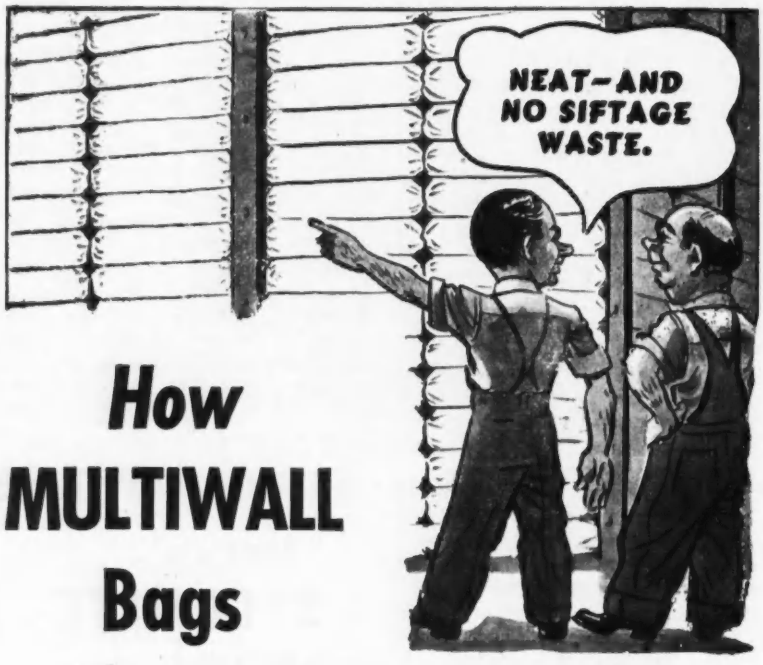

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Anderson Warns Of Citrus Surplus

Clinton P. Anderson, U. S. Secretary of Agriculture, principal speaker at the annual meeting of the Florida Farm Bureau Federation at Or-

lando, warned Florida citrus growers that they must face the problem of new and better methods of salsemanship to meet the prospect of a surplus production of citrus fruits in the years ahead. Mr. Anderson was taken on a sight-seeing trip through Florida citrus groves, packing houses and juicing plants.

USD Suspends Storage Limitation On Restricted Commodities

Under War Food Order 111, which regulates use of food storage facilities, the U. S. Department of Agriculture has suspended indefinitely all provisions restricting cooler storage of cereals, beer, canned condensed milk, canned fish, canned fruits and vegetables, canned cheese, Carter's spread, dried skim milk, dried whole milk, evaporated milk, peanuts in the shell, and sterile canned meats.

Restrictions on nuts in the shell have been suspended except for those on in-shell nuts in ten port cities, or within 20 miles of their corporate limits. The cities are: Baltimore, Maryland; Jersey City and Newark, New Jersey; Los Angeles and San Francisco, California; New York City, New York; Norfolk, Virginia; Philadelphia, Pennsylvania; Portland, Oregon and Seattle, Washington.

All other provisions of the order remain in effect, as well as restrictions on nuts in shells in the ten port city areas.

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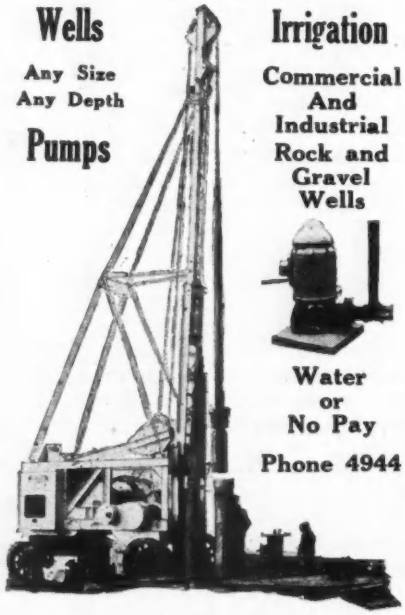

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Reports Of Our Field Men . . .

POLK COUNTY
J. M. (Jim) Sample

The fall fertilizer application is now completely on, finishing earlier this year than any time in the past. Amounts of nitrogen were increased somewhat in practically all groves to make up for the loss occuring from the heavy summer rains. There is a great deal of scale in many of the groves at this time and with sufficient moisture conditions oil sprays are now being applied. In some groves purple scale is preponderant but in most properties nail-head is heavier. In these oil sprays, being applied now, the oil is used at 1.4 percent concentration, and wherever a thorough job of spraying is done, the scale is being killed with this strength. Rust mites are also active and some few colonies of purple mites have been noticed, causing some defeliation on young trees. The Parson Brown and Hamlin oranges, with low solids this year, are just about cleaned up in this section, and pineapples are beginning to move in volume. Tangerines are also being picked.

NORTH CENTRAL FLORIDA
V. E. (Val) Bourland

We are well under way with our fall application of fertilizer and this will be completed by the first of the year. Scale insects have been causing a great deal of extra work for the past few weeks and many growers are still busy with their spray machines getting this pest under control. Rust mites are also very active. Fruit has been moving to market at a rapid rate and it is now evident that we did not have as much early bloom as was at first anticipated. Prices have been holding up well and growers in general are well pleased with the results to date and are hopeful of good prices prevailing throughout the season. Vegetable crops are moving to market from the Winter Garden and the Zellwood area. Prices have been good and it appears that production will be up to par on most vegetable varieties. Watermelon growers are beginning to put out their fertilizer and plantings will get under way during the latter part of December and the first of January. Many growers are still finding it difficult to obtain adequate labor to take care of the many chores that should be handled at this time.

HILLSBOROUGH & PINELLAS COUNTIES
C. S. (Charlie) Little

It now appears that we will have a period of time around Christmas and during the weeks to follow that it will be hard to find fruit to place on the market. In other words, the early bloom will have been moved and the later bloom will not be ready to ship. Growers have gone forward with their fall application of fertilizer and are about through with this operation at the present time. The application was a little heavier this fall than in previous years due to the heavy summer rains and because of the preponderance of late bloom fruit that growers are trying to size up a little before trees are dormant. Scale insects are very much in evidence, and it appears that we are having more trouble with these insects every fall. At the present time growers are busy with oil sprays in an effort to get these pests under control. There are a number of groves that have had wood killed by scale in recent weeks. Prices are very good on all varieties of fruit and with the scarcity of early bloom it now appears that the price will be even better as the season progresses. Canning plants are very active in their buying program in this territory.

WEST CENTRAL FLORIDA
E. A. (Mac) McCartney

This territory is one of the finest tangerine producing sections in the state and we have more tangerines in this area than in most other parts of the state so with prices on this variety of fruit at its present level growers are very enthusiastic over their prospects for the season. Of course we do not expect for prices to be maintained at the present level throughout the marketing season but that is not necessary for a nice profit to be ralized. Furthermore, growers are getting good prices for their other varieties of fruit. We are just about through with our fall application of fertilizer and groves have been thoroughly cultivated and let go for the winter. They are certainly pretty at the present time. We have some properties that should be pruned but this is almost impossible at the present time with labor demanding almost exerbitant wages.

SOUTHWEST FLORIDA
Eaves Allison

Growing conditions have continued favorable during the past month. With the coming of cooler weather fruit is rapidly breaking in color but trees are continuing to show signs of some growth. Some sections are beginning to show need of more moisture. Our fall application of fertilizer is just about over but there are a few growers delaying their application until December. The fall cuke crop, while not heavy has been satisfactory, with very good prices prevailing during the early part of the season. Tomatoes and eggplant are moving in good volume and shipment of gladiolis have started from the Bradenton and Fort Myers sections. The general outlook for all crops at the present time is good. Labor is still a problem and with the scarcity of many items of equipment growers are laboring under a definite handicap. However, as the country swings back to normal these matters will adjust themselves and we can go back to our old worries of prices and the weather.

Slaughter and Taylor are our new agents at Palmetto and we are sure that these boys will do a thorough job for the growers of their section. Tom Slaughter has recently been discharged from the Army after many months of frontline action in Europe. Jack Taylor has been connected with the Farmers Market at Palmetto and has done a splendid job for the growers of his section."

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A heap of the trouble we get into in this world is of our own makin' . . . but one of the big problems the citrus grower is facin' today is one he didn't have no part in settin' up . . . we're talkin' about the way the citrus trees put on their bloom this year . . . the extremely dry weather early in the season made the bloom jist plumb cockeyed and packin' houses is havin' plenty of worries in their job of pickin' the fruit . . . and everybody is kinda disturbed tryin' to figger out if the late bloom is goin' to be good quality 'r not.

Usually when we have a bloom like we had this year we have trouble fer several years gittin' the trees back to bloomin' when they ought to. If this cold weather we're havin' right now will stay cool for the next few months and keep the trees absolutely dormant until its time for the trees to bloom for the next crop, then the answer will be provided, and we'd git a normal bloom at the proper season . . . you can't always out-guess Old Mother Nature though, so we'll jist have to wait and see what she does.

Last spring's drought shore boomed the irrigation business among Florida's fruit growers . . . in fact, it just finished a job most everybody knew had to be done sooner or later, in making irrigation equipment a plumb standard necessity if over a period of years we want to keep our trees in good shape and our crops the kinda fruit we want . . . the only reason more irrigation systems hasn't been put in this summer it is 'cause they wasn't enuf labor to install needed equipment . . . the outlook is a heap brighter fer givin' trees plenty 'o water next spring tho' than it was a year ago.

There's goin' to be a heap of buildin' and repairin' done around a lot of growers places jist as soon as material and labor gits to where you kin git it . . . restrictions has been lifted but they jist ain't enuf material to go 'round right now, but it won't be long now, 'til there'll be the darnest mess o' hammerin' and sawin' you ever saw.

The American Farm Bureau Federation has set up a fruit and vegetable department with Porter R. Taylor as director, with the idea of helpin' producers of these crops with their distributin' and economic problems . . . a national committee of fruit and vegetable producers will supervise the job . . . which'll be a help to folks growing pertaters, citrus and sich.

This business of raisin' funds to have representatives go to South America and study this here Triesteza disease which is killin' off so many sour orange root stock trees in them countries, is somethin' every grower ought to be glad to contribute to . . . the time to stop that same disease from gittin' into our own groves is while it is still confined to countries several hundred miles away from us.

Uncle Bill

Swift & Co. to Move Fertilizer Plant

Announcement is made that the fertilizer plant of Swift & Co., which has long been in operation at Agricola, is about to be moved to Winter Haven where a site has already been chosen and purchased.

The Winter Haven plant, it is said, will be on a much greater scale than the present plant at Agricola, and will be equipped with the latest in fertilizer manufacturing machinery and will give employment to a large force of workers.

Removal of the plant to Winter Haven is said to be due to the rapid expansion of business and greater transportation facilities afforded at that place.

Canned Grapefruit Juice Subsidy Program Amended

In order to further assure all canners of reimbursement on a comparable basis, the U. S. Department of Agriculture has adjusted its canned grapefruit juice subsidy offer of last June 21 to reflect more accurately the canners' costs of raw fruit on which subsidy payments are based.

The action, taken under an amendment to the original subsidy offer, became effective November 9.

The original method of computing "seasonal fruit costs" did not reimburse canners who had made sales in civilian channels before November 10, 1944, on a basis which was comparable to the reinbursement received by canners who had not made such sales. The new change affects only canners who made such sales before November 10, last year.

In computing a canner's seasonal fruit cost, the quantities of grapefruit juice sold in civilian channels each month before November 10, 1944, will now be deducted from the respective month's total production. This deduction is in addition to the deductions, provided in the original offer, of sales of juice to government agencies and for export.

The original subsidy program was authorized by the Director of Economic Stabilization as a means of avoiding an increase in the price of grapefruit juice to consumers.

BRAZILIAN TEACHER IS DOING GRADUATE STUDY AT STATE UNIVERSITY

Jurema S. Aroeira, Brizilian professor of horticulture, is now taking graduate work in agriculture at the University of Florida, Dr. H. Harold Hume, University provost for agriculture, announces.

Professor Aroeira, a member of the faculty of the College Gerais, Brazil, studied under the late Dr. P. H. Rolfs, who was dean and director in the University of Florida College of Agriculture before he went to Brazil to establish the school in Minas Gerais.

The Brizilian teacher is primarily interested in citrus and sub-tropical horticulture and is majoring in these fields in his graduate study. He is attending the University of a scholarship granted by the Institute of International Education, Provost Hume said.

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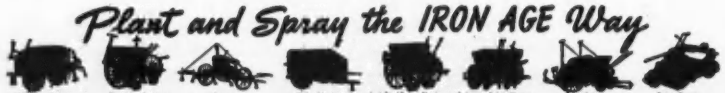

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CONTROL OF THE SHOT-HOLE BORERS IN CITRUS TREES

(Continued from page 3)

Stock material containing DDT was used dispersed in water for spraying the tree trunks. The materiai was a powder containing 40 percent DDT and was used at the rate of 2-1/2 ounces per 1 gallon of water or at a dilution of 1 ounce of actual DDT per gallon. Pure DDT is not soluble in water so it is incorporated with a material that will mix with water and the stock materials usually available on the market contain 20 percent, 25 percent, 40 percent or 50 percent of actual DDT. If an ounce of actual DDT per gallon of water is desired and the stock material contains 25 percent DDT, then 4 ounces of the stock material should be used, or if the stock material contains 40 percent DDT only 2½ ounces are necessary. Further tests may prove that a more dilute spray may be sufficient to kill the beetles but until more information is available it is better to use more than is necessary to insure control since no tree injury was observed and only a few gallons of spray per tree is necessary. It might be well to spray the trunks of trees adjacent to those already infested to prevent further infestations since the beetles will attack healthy trees.

A knapsack sprayer can be used to apply the spray since the beetles usually infest only the trunks of the trees. Care should be taken to keep the solution agitated in the sprayer.

Periodic inspections should be made for reinfestations or new infestations on trees that had not been previously infested. An attempt should be made to get the trees with injured roots into a vigorous condition as soon as possible so that they will resist attacks of the borers. Trees having root systems that have been reduced by high water are likely to suffer for lack of moisture as soon as the top soil becomes dry and irrigation may be necessary at an early date to promote tree recovery. All dead and dying trees should be taken out of the grove to prevent a continuing source of reinfestations.

Alachua County farmers are showing increasing interest in reforestation, and many of them have applied recently for slash pine seedlings for planting within the next few weeks, according to County Agent Loonis Blitch.

296663

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Reminder For This Month

If you haven't applied fall fertilizers to your citrus trees, it is vitally important that you do so promptly. Remember, the quantity and quality of next season's crop depends upon this fall application.

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THE GULF FERTILIZER COMPANY

Tampa And Port Everglades, Florida

PRESENT STATUS OF DDT AS AN INSECTICIDE

(Continued from page 7)

worthy pests as the following submit to DDT: the cabbage looper (**Authorgrapha brassicae** (Riley)), the diamondback moth (**Plutella maculipennis** (Curt.)), the imported cabbage worn (**Ascia rapae** (L)) the cabbage webworn (**Hellula undalis** (F.)), the tomato fruit worm (**Heliothis armigera** (Hbn.)), the potato leafhopper (**Empoasca fabae** (Harr.)), the pepper weevil (**Anthonmus eugenii** Cano), the potato flea beetle (**Epitrix cucumeries** (Harr.)), the potato psyllid (**Paratrioza cockerelli** (Sulc)), the striped cucumber beetle (**Diabrotica vittata** (F.)), the spotted cucumber beetle (**D. duodecimpunctata** (F.)) the pickleworm (**Diaphania nitidalis** (Stoll)), the Colorado potato beetle (**Lepitinatarsa decimlineata** (Say)) the bean leaf-roller (**Coniurus proteus** (L.)), the cross-stripped cabbage worm (**Evergestis rimosalis** (Guen.)), the garden flea hopper (**Halticus bracteatus** (Say)), the melonworm (**Diaphania hyalinata** (L.)), the pea aphid (**Illinoia pisi** (Kltb.)), the potato aphid **M. solanifolii** (Ashm.)), the green peach aphid (**Myzus persicae** (Sulz)), the onion thrips (**Thrips tobaci Lind.**), and the garden webworm (**Loxo stege similalis** (Guen.). Swingle and Mayer (13), Campbell (14), Hill (15), White (16), Gyriska et Al. (17), Goodhue et Al, (18).

Dust formulations consisting of DDT at 1 to 10 per cent levels with such diluents as pyrophyllite or talc were used in testing the control of the aforementioned species, as well as sprays consisting of DDT suspensions, or emulsions, and aerosols.

In some instances such as the Mexican bean beetle (**Epilachna varivestis** Muls.), the squash bug (**Anasa tristis Deg.**), and the harlequin bug (**Murgantia historionica** (Hahn)), etc., the results are not satisfactorily effective for the DDT formulations employed thus far in most field research investigations. White (16). In other cases some aphids and red spiders increased following DDT applications.

Pests of Citrus

The reports of DDT research on Pests of Citrus have been very limited thus far. Preliminary investigations indicate that certain formulations are lethal to some species and possess residual qualities. The emulsive petroleum oil solutions of DDT seem to be more effective as contact and residual sprays than other types of formulations.

In the case of certain Coccidae, the scale crawlers seem to be inhibited from settling for periods of time ranging up to 55 days. The adult female scales may also succumb to the poison. Lindgren and Boyce (19). Weather conditions greatly influence such residual effects.

Thus far it does not seem that the DDT formulations are any more effective than oil emulsions in the control of the Citrus whitefly (**Dialeurodes citri** Ashm.). The author conducted field tests on this species with a DDT emulsion. A twenty per cent stock emulsion was used at rates of one quart and one half gallon per 100 gallons of water.

The killing and protective powers of such sprays were low. Greater concentrations might prove effective. On sprayed Citrus trees there seemed to be a contact and residual effect upon the adult whitefly.

Swingle and Mayer have reported that a 3 per cent DDT dust is quite toxic to the spirea aphid (**Aphis spirecola** Patch). Swingle and Mayer (13).

Miller has reported that preliminary tests with DDT formulations failed to produce a satisfactory reduction in Citrus rust mite **Phyllocoptes oleivorus** (Ashm.)), while Osburn reports that it effectively controls the little fire ant (**Wasmannia auropunctata** (Roger)), in the east coast citrus area of Florida. Miller (20), Asburn (21).

Investigations on some crops such as cotton have revealed that aphids and red spiders are increased due to DDT applications. This may eventually prove true with regard to some species on Citrus.

The residual quality of a spray is rather advantageous in the control of specific species. However, the fact that DDT is definitely toxic to some of the entomophagous species may constitute a tremendous limiting factor to its use in certain cases. In Florida Citrus production we are aided by the numerous beneficial insect species. Any toxic spray that would seriously interfere with the biotic complex might constitute a danger to citrus production. In preliminary tests the author found that the twice-stabbed lady beetle (**Chilocorus stigma** (Say)) is suspectible to DDT as a contact spray and as a residue.

(To be coninuted next month.)

15145-12/20

Most shrubs and trees that are properly watered and fed require little additional attention to protect them from parasitic diseases.

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